Diagnostics for the SFOF Mark IIIA Central Processing System: Real-Time Background Routines

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The on-line diagnostics for the Space Flight Operations Facility (SFOF) Central Processing System (CPS) have been modified to provide real-time diagnosis of equipment performance. Real-time diagnostics can be run while mission flight support continues. This is possible since any diagnostic can now run as an independent task under the mission real-time job step. The real-time capability allows certification of CPS hardware elements immediately preceding their commitment to mission flight support.

I. Introduction

This article describes an extension of the Diagnostic Monitor (DIAMON) for use on IBM 360/75-related hardware. In its improved form, DIAMON provides additional assurance that the Central Processing System (CPS) is completely operational by testing selected hardware interfaces and on-line devices concurrent with flight support (i.e., in real time). Previous articles (Refs. 1, 2, and 3) have described the independent or "standalone" diagnostics, their implementation for pre-mission checking of the CPS, and the on-line diagnostics.

II. Required Capabilities

The use of multiprogramming in Mark IIIA limits the value of a diagnostic that requires an operating system different from the flight support system, or exclusive use of key facilities. The proven worth of hardware diagnostics led to the evolution of DIAMON from one which operated under the JPL Operating System (JPLOS) with exclusive use of the real-time job step (RTJS) to one which would run as one of several independent tasks under the mission RTJS.

Sharing the RTJS requires additional features: attaching DIAMON to the Mission RTJS, routing data from the tested device exclusively to DIAMON, and returning the tested devices to the original user.

III. Implementation

Figure 1 shows the current Mark IIIA 360/75 Operating System and the relations between the RTJS, DIAMON, and the Mission Support System.

The real-time diagnostics run under JPLOS with first-level control by DIAMON. Control messages have been provided which attach and delete DIAMON as an independent task under the mission RTJS. Other control messages start and stop input/output to peripheral devices. The control messages are entered on CRT display stations.

IV. Operation

After DIAMON has been attached to the mission RTJS, selected CRT display stations may be used to enter diagnostic requests. Diagnostics can be run on any device that is allocated to the mission RTJS. The diagnostic request for a device also results in reserving the device for DIAMON. The same program logic used to control input/output to devices also isolates the device exclusively for DIAMON use.

Diagnostics can be run concurrently on different device types. Some diagnostics are re-entrant, allowing several devices of the same type to be checked at the same time.

V. Further Extension

The real-time diagnostic capability also provides a base for detecting system faults as soon as they occur. Under a combination of operator and program control, diagnostics would be used to exercise selected system functions during periods of low activity. DIAMON would be expanded to also test the instruction set, arithmetic functions, and some control functions. Core reliability would be checked by making normal core requests, testing the assigned area, and then relinquishing it. This type of continuous verification would significantly enhance system performance by detecting system faults in time to be corrected for mission support.

VI. Conclusion

The modification of DIAMON now provides a real-time diagnostic capability that can be used without significant impact on mission support. When not required, it is disk-resident and only the essential modules are loaded when a diagnostic request is entered. Sharing the RTJS allows other mission programs to continue with the remaining facilities.

With the real-time diagnostics, it is now practical to verify proper device operation prior to every usage rather than to wait until problems degrade the system below mission requirements.

References

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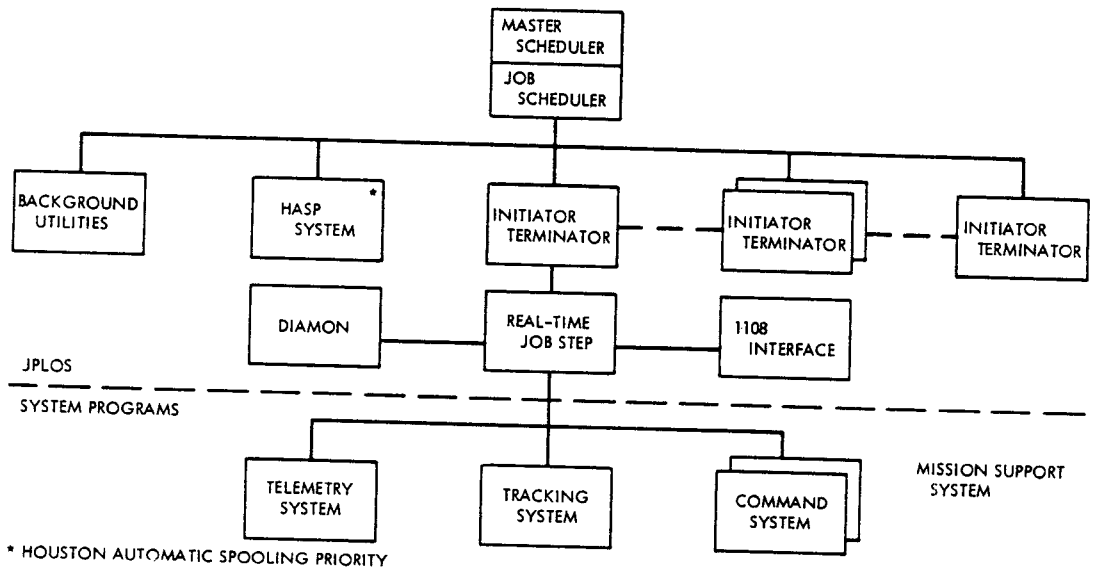

Fig. 1. Mark IIIA 360/75 Operating System